

Chapter 17

Techniques of Motivating Students in Learning Psychomotor Skills in Engineering and Technology Education Programme

Saba T.M., Audu R.,
Abutu F. &
Kareem, W. B.

Aim

To understand techniques of motivating students to learn psychomotor skills in Engineering and Technology Education.

Specific Learning Outcomes

After reading this chapter you should be able to:

1. Enumerate three strengths associated with the utilization of instructional materials.
2. State two criteria for selecting instructional materials for utilization.
3. Mention at least three points to be observed for effective utilization of instructional materials
4. State at least four safety precautions in workshops/laboratories.
5. Define maintenance.

Introduction

The future of any nation does not only depend on the abundance of material resources she possesses but also on specialized knowledge, skills, competence and abilities possessed by its populace which can be harnessed to utilize its material resources. University is the institution for the preparation of needed manpower to accelerate the growth and development of the economy. Currently, education is the vital gift a country can present to its citizens. Appropriate

scholarly training must focused on acquiring relevant knowledge as well as skills. It must lead to effective application of acquired competencies in solving real life problems. An appropriate scholarly training should empower trainees with the technical skills and knowledge needed in the work place or industries. Currently, the large population of Nigerian applicants is an indicator that several students upon graduation lack the relevant technical competencies needed in the industries or work place.

Engineering and technology education can be described as an orderly pattern of training individual for actual activity for manufacturing products as well as offering services to cope with the desires of human needs in the society. This is principally a professional kind of schooling. This kind of scholarly activity encompasses entire training of trainees in which trainees acquires knowledge adequately to carry on a paid job. This kind of professional education concentrates on practical tasks or teachings that centred on learning by doing to come up with useful products that are of benefit to the society. It can be described as a field of study that focuses on the application of scientific ideas, innovation as well as materials to find solution to human problems and enhance effective existence in the society. This field of study trains skilled persons that could handle as well as control products or outputs of innovations in the real life either in enterprises or in industrial organizations.

The programme assists trainees to reason rationally in technological environment and also helps trainees to utilize technology in a sustainable manner with consciousness of the environmental impact. It entails bridging the gap between theory as well as practice and establishing strong linkage in their applications via activity oriented pattern of learning. Incentive to acquire knowledge is assumed to contribute significantly in the acquisition of psychomotor skills, motivation is a determinant of thought and action which help learner's to learn concentrate. Incentive in form of encouragement is possibly the vital variable that instructors could use for the purpose of enhancing acquisition of psychomotor skills. Ogwo and Oranu (2006) observed that, carefully planned lesson with necessary facilities and well-delivered lessons energise and sustain student's interest in the learned material.

Encouraging trainees is a vital variable that is needed for functional scholarly training (Forster-Heinzer, Holtsch, Rohr-Mentele & Forster-Heinzer, 2016). They further said that, without regular encouragement of trainees, no meaningful learning could take place. In the opinion of Lengnick-Hall and Sanders (1997), trainees are basic ingredients for any scholarly activity and also

several trainees are vital elements of work place active in bringing about functional scholarly activity and practice. It is difficult to teach a discouraged trainee except he/she is ready willing to learn. Saba (2010) stated that during the process of psychomotor acquisition students should be motivated, as motivation acts as initial activator and sustainer of desired intention necessary to trigger the action in acquiring skills. As interest promote learning the interest of the students must be arose to that degree. This can be achieved if the institutions make available needed facilities for students' use, the school arena must be suitable for learning, and also appropriate techniques should be used in course delivery for adequate transfer of knowledge and effective maintenance of equipment and facilities in workshops/laboratories.

Techniques of Motivating Psychomotor Skill Development

For effective development of psychomotor skills, the following techniques must be considered:

1. Effective and functional instructional facilities
2. Appropriate use of instructional methods
3. Adequate Safety practices in Workshops/Laboratories
4. Proper Maintenance of equipment and facilities

Effective and functional instructional facilities

Facilities can be defined as all the resources which may be used by the teacher/learner in isolation or in combination, formally or informally, to facilitate the acquisition of knowledge, skills and moral (Inyangi, 1988). In this paper, facilities are group into three, teaching facilities, training equipment as well as physical facilities. Engineering and technology education discipline that lays much emphasis on skill-acquisition cannot function well without adequate provision and use of facilities like books, equipment, tools, materials, workshop and laboratories. This is because skills are not acquired in the air or with empty hands. For effective teaching and learning, four major elements have been identified, namely: the learner, the curriculum, the teacher and the facilities. Acquiring of technical knowledge as well as practical competencies plus functional professional behaviour and attitude that would facilitate efficient occupational training required good manipulation of skill oriented instructional facilities in a conducive learning situation (Olaitan, Nwachukwu, Igbo, Onyemachi & Ekong, 1999). They added that such learning situation can be

created through effective production and utilization of instructional materials. Instructional materials were viewed as aids, designed to help technology instructors in instructional delivery to facilitate transfer of occupational competencies directed toward learning and acquisition of skills for work (Saba, Bukar, Raymond & Tsado, 2011).

The effective utilization of teaching aids for instructional delivery as well as knowledge acquisition in engineering and technology education involves adequate use of tools and equipment, fixed facilities and consumables in the teaching-learning situation. Olaitan et al. (1999) enumerated some of the strengths associated with the utilization of instructional materials as follows:

- a. The learner will be provided with the knowledge and skills of manipulation and management of equipment, tools and materials.
- b. The learner will be exposed to opportunities that will help him develop skills of self-instruction.
- c. It will help mastery of knowledge of manipulation processes which can enhance retention, recall and improvement of what is learnt through substitution of materials devices.
- d. It enables the learner to diversify knowledge and skills in the utilization of instructional materials. That is, the learner can use materials for other purposes.

Gambari and Gana (2005) observed that, there are lots of problems facing the effective teaching of pure science, applied science and engineering related disciplines at all levels of educational institutions. One of the problems they highlighted was ineffective communication channels through which pieces of information, ideas, and concepts could be disseminated to the learners. Effective communication through instructional media is paramount to effective teaching and learning. Learning progresses adequately when the learner's interest is aroused and also when the learner perceives some organization in the material he/she is learning. Unorganized instruction materials usually lack meaning; their motivational effects usually poor and the possibility of their effective use is doubtful. Gambari and Gana (2005) outlined some of the contributions that instructional media can make towards effective teaching and learning of engineering course:

1. they provide increased interest in learning;
2. they provide a variety of reality of instructional tasks that enhance personal tasks by the learners;

3. they ensure effectiveness of teaching and learning through concretizing ideas and engineering creativity;
4. they provide better knowledge attainment as well as more appropriate knowledge retention;
5. they provide trainee with the avenues for free learning at his own pace; and
6. They hold the learner's attention.

Criteria for Selecting Instructional Materials for Utilization: Engineering and Technology education differs in content, objective and approaches in teaching and therefore the differences in the materials to be employed in the teaching-learning situation. It then calls for the necessity to choose the appropriate items for utilization as it suits the need as well as competencies of trainees on the basis of proposed constructs to be taught and learnt. According to Nwachukwu, (2006) the criteria include the;

1. Objectives of intended experiences
2. Content of the lesson
3. Capabilities of the learners
4. Competencies to be illustrated
5. Helpful services to be carried out
6. Teacher's psychomotor competencies
7. Learners level of maturity
8. Product to be produced
9. Situation to be used

Economy of Utilization of Instructional Materials: The economy of utilization involves the considerations and practice carried out to ensure the effectiveness of the utilization of teaching aids in technical learning situations in transfer of knowledge and skills to learners (Nwachukwu, 2006). It also involves the careful and sustainable use of technical instructional materials. He further stated that, careful and sustainable use of materials will ensure:

- a. Durability and longevity of the materials

- b. Reduction in maintenance cost
- c. Saving time wastage in using them
- d. Easing the usage of the tools and equipment during operations

The economy of utilizing technical instructional materials has some basic principles. Among them are:

1. Knowing what instructional materials to select for use
2. Knowing how to use them
3. Knowing when to use them
4. Knowing the actual operations to apply them

Nwachukwu (2006) said that, for effective utilization of instructional materials, the following points should be observed:

- a. Proper guidance of students during usage to ensure proper handling of the tools and materials.
- b. Provide adequate maintenance of the various tools and equipment both during storage and after use.
- c. Introduce supporting materials and devices to ensure effectiveness of their usage in practical situation.
- d. Provide proper storage for the tools and equipment to ensure longevity and sustainability.
- e. Replace worn-out materials or parts, where necessary, for continued services.
- f. Adequately educate students on the specified technical instructional materials in an instructional situation.

Learning is the procedure which equips trainees with training tasks geared towards bringing about behavioural modification that will be of positive value to the society as well as increase in the development of the trainee generally (Ogwo & Oranu, 2006). The authors further enumerated certain vital factors which influence the manner in which trainees acquire knowledge in technical courses to encompass the following:

1. We learn best when we are ready to learn.
2. The more often we use what we learned, the better we perform or understand it, long disuse can result in decay.

3. Learning something new is made easier if the learning can be built upon something we already know.
4. Learning takes place by doing. Before learning can become complete we must put into practice what we are attempting to learn.
5. Appropriate knowledge acquisition motivates the desire to acquire more knowledge. Difficulties in knowledge acquisition inhibit future desires to acquire knowledge.
6. Knowledge acquisition is appropriately achieved only if the knowledge acquisition arena is properly controlled or regulated. Thus, knowledge acquisition arena must be properly furnished for appropriate knowledge acquisition activity.
7. A trainee acquires knowledge faster only if the instructional materials to be taught is suitable, appropriate as well as interesting to several sense organs such as touch, taste, hearing, smell as well as sight. Use of several organ senses would assist understanding as well as stimulate zeal in the material to be taught.
8. Knowledge demands incentive since zeal is needed for efficient knowledge acquisition.
9. Feeling and emotions are strong incentives for learning.

Appropriate use of Instructional Method

A skilful technology teacher will use different methods in rotation and combination as will be indicated by the existing needs. Efficient tutoring of specific competency activities approaches as well as instructional items perform a vital function in enhancing the trainees' attainment of goals (Saba, Ma'aji & Tsado, 2012). Competencies achievement usually demands professional tutorial modalities for the purpose of attaining suitable targets. Helping trainees to acquire knowledge is major target of any tutorial task in either informal as well as formal school setting. For enhancing knowledge acquisition in schools, tutors teach trainees based on the planned learning experience packages via utilization of suitable instructional items which perform vital functions towards bringing about efficient, motivating as well as zealous knowledge acquisition (Ukoha & Eneogwe, 1996).

While tutoring skills, it is necessary for sufficient repetitive of the skills taught as it enhances understanding. The instructors should encourage the learners to "practice, practice and practice" in order to maintain their sharpness. For effective teaching to occur, skilled instructors are charged to utilize different

approaches as well as skilled modalities of tutoring at discretion. In as much as there exist immense diversification in instructional approaches, there is particular approach that could be considered as most appropriate. A properly planned tutorial approach could perform efficiently in enhancing appropriate knowledge acquisition. Careful and intelligent analysis of the educational purpose will determine the method to be employed. Okoro (2006) narrated that field trips, experimentation, project, demonstration, questioning, and discussion as well as lecture approach are possible tutoring approaches which could be utilized in technology education and Engineering programmes. He further added that projects as well as experimental approaches are only suitable for technology subjects where greater proportion of time is allocated.

Many methods which are today used in transmitting and sharing knowledge with learners include lecture, discussion or questioning, guided discovery, inquiry problem solving, practice and drill, field trips and excursion, role-playing, games and simulation, project, among others. Despite the use of these methods, current research status indicates that no one method is superior to the other. What dictates the desire of an approach is basically nature of content that is to be taught. This is where the ingenuity and resourcefulness of the teacher comes to bear. Teachers by their training should be able to isolate a particular method they need to adequately impact knowledge to the learner, which will make the learning concrete and permanent.

Demonstration method is principally accepted as the most efficient and effective technique of teaching engineering and technology education courses. Through demonstration, the students see visually and audibly what is taking place. Demonstration must be skilfully planned; demonstration can be class demonstration, small group and individual demonstration. Demonstration, if properly planned and carried out, has the following advantages: student attention is mostly attracted; immediate progress performance can be achieved; appeals to senses of seeing and hearing; it makes learning concrete.

Laird (1985) in Saba *et al.* (2011) narrated that demonstration would be effective when the instructor carries out the under listed tasks:

- has sufficient instructional aid while teaching;
- ensures effective functioning of machines before commencing teaching;
- narrates the objective of the approach to be adopted;
- allows learners to try out the demonstrated skill at end of each operation;

- organizes as well as rehearses competencies he /she intends to teach prior to actual teaching to enhance mastery;
- encourages students to ask questions

Project is a learning activity selected, planned, designed and executed by learners collectively or individually to clarify facts, acquire new knowledge, skills, appreciations to solve identified problems under the teacher's guidance and supervision (Ukoha and Eneogwe, 1996). The teacher assigns an individual or a small group to a specific task that involves creating, doing or experimentation. The project method of teaching is a cooperative study of real life situation by the class or little group. Project method can also be used in teaching technical subjects though it is seldom used. However, it is meant to help learner to think and decide things for himself. Project could be in form of practical exercise and fully supervised by the teacher. It allows a direct perception and helps the formation of concrete ideas, because almost all sense organs take part in the practical skills. They also have a moral satisfaction from the positive result.

The project method is often derived from the course content to reinforce abstract learning and develop skills in the use of equipment, tools and materials. The construction of a project requires trainees to adopt competencies as well as knowledge he has learnt. The teacher guides students and provides assistance whenever it is required. Project method has the following advantages:

- It fosters co-operation among the learners leading to the acquisition of co-operative work skills.
- It unifies knowledge from various fields of disciplines thereby enabling learners to see relationships between them and their practical applications in life.
- It encourages freedom of expression and creativity.
- It is an excellent method for the acquisition of problem solving skill and rational thinking.
- The method motivates and challenges the learner as they work toward the stated purpose.

Several engineering tasks are carried out in groups via collective interactions among team members and more emphasis is on practical technology skills needed for ensuring completion of occupational tasks. Felder and Brent (1994) unveiled that several industrial employers currently attach more value to

employees' ability to work collaboratively in groups than working individually. The demand for team work ability calls for the need to teach trainees in groups or cooperatively. Several empirical researches support the efficiency of cooperative instruction approach in enhancing team learning (Felder & Brent, 1994). They furthered unveiled that compared to trainees tutored conventionally or individually as well as in teams, trainees tutored in teams displayed better academic achievement, retention as well as interest. It was also discovered that with this approach, there are less number of home works report to assess.

Teach approach to learning also helps weaker trainees to pick courage to strive to acquire knowledge as well as skills from the intelligent trainees. It permits sharing of knowledge among team members freely unlike in the individualized approach where trainees are forbidden to work together. Via team work, weaker trainees pick courage to learn because they believe other trainees are looking up to them to excel in class. This approach to knowledge acquisition enhances the growth of interpersonal skills needed for positive interdependence as well as social skills among trainees.

Safety in School Laboratory/Workshops

The workshop contains many potential safety hazards. These hazards can be eliminated through proper control. Instructors have an important role to perform in workshop safety as they help to unveil unsafe situations and practices thereby reducing accident rate. Instructors could build care and confidence in their students by the manner of handling tools and equipment. Regulation approaches would vary from instructor to instructor but it is necessary for instructors to be fully aware of the hazards and risk in the workshop/laboratories and thus prepare the workshop environment in line with standard factory act to ensure safe work environment and thereby motivate learners to learn skills.

Safety Precautions in Workshops/laboratories

1. *Dress appropriately.* Avoid wearing unfitted garment. Every trainee must put on overall while working in the workshop.
2. *Trainees should not work alone in isolated places in the laboratory.* People should be aware of the location you are working.
3. Trainees in the workshop must not indulge in horse play.
4. Trainees must put on safety gadgets when handling gases as well as chemicals. It is wrong to directly taste chemicals during usage as some could be harmful and poisonous.

5. Never utilize any tool or equipment which you are not trained and permitted to utilize.
6. Switch off electrical connections prior to making modifications on the connections.
7. Never forget to complete a practical task that is already in progress.
8. Be conversant with the position of fire extinguishers as well as other fire fighting gadgets.
9. Treat all personnel in the workshop with care.
10. Tidy up your hands when you finish working on hazardous chemicals.
11. Trainees must carefully manage inflammable substances.
12. Each laboratory should keep a log book for documentation of laboratory activity.
13. Switch off all equipment powered by electricity or gases after use.
14. Never move about with sharp edged objects in pockets.
15. Always maximize the utilization of protective safety gadgets to reduce electrocution as well as fire outbreak.
16. Safety regulations in workshop should be clearly shown for all to see and comply with.

Cultivating Positive Maintenance Culture among Teachers

Teachers and instructors must never lose sight of the significance of maintaining tools and equipment in the laboratory/workshop as it plays critical role in motivating students to learn skills. Maintenance according to Saba (2006), is the act of taking good care of tools and equipment to prolong its lifespan and to prevent it from sudden breakdown. Jarret (2000) sees maintenance as a process whereby machines are constantly checked and faults rectified to avoid any loss in man-hour and to increase production. In other to motivate students to learn skills, it is necessary for instructor to always maintain equipment and tools, and this can be done when he or she believes that;

1. Nothing is useless.
2. There is no end to the use to which equipment can be put.
3. All hazardous signs in all equipment must be promptly given attention.
4. It is unwise and indeed an attempt of wastage to permit gadgets to deteriorate to a point of collapse/breakdown before it is maintained.

The tools and equipment must be put in good working condition for three basic reasons:

1. To promote a high degree of efficiency
2. To maintain safe working conditions
3. To encourage students to learn skills. As students work with unmaintained equipment or machine, they easily develop negative attitude towards the work.

Conclusion

Motivational activities towards students learning psychomotor skills are very important in Nigeria today, as the advancement of any country is paramount to the sustainable existence as well as relevance of that country. Engineering and technology education is the solution to the present under-industrialization and hope for millions unemployed Nigerians. Therefore, it is necessary that instructors should create friendly atmospheres where students can learn psychomotor skills without resistance.

Evaluation/ Self-Assessment Exercises (SAEs)

1. Enumerate three strengths associated with the utilization of instructional materials.
2. State two criteria for selecting instructional materials for utilization
3. Mention three points to be observed for effective utilization of instructional materials
4. State four safety precautions in workshops/laboratories.
5. What is maintenance?

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